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WOODS HOLE OCEANOGRAPHIC INSTITUTION
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TECHNICAL MEMORANDUM 7-79

THE ACODAC AMBIENT NOISE PROGRAM

Earl E. Hays

June 1979

WOODS HOLE, MASSACHUSETTS 02543

WOODS HOLE OCEANOGRAPHIC INSTITUTION
Woods Hole, Massachusetts 02543

TECHNICAL MEMORANDUM 7-79

THE ACODAC AMBIENT NOISE PROGRAM

prepared by

Earl E. Hays

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Office of Naval Research Contract No.
N00014-71-C-0057; NR QLR-047

Final Technical Report

The ACODAC Ambient Noise Program

17 September 1970 - 30 September 1978

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The ACODAC Ambient Noise Program

Introduction

Measurements of ambient noise in areas of interest to the U. S. Navy for any reasonable length of time, other than at fixed installations were scarce in the 1960's. In late 1968 discussions between E. Hays (WHOI) and J. B. Hersey (ONR 102S) evolved into the concept of a long time recording capsule with multiple hydrophones in a vertical array to record ambient noise using the new solid state technology. E. Hays went to SACLANT ASW Centre La Spezia as Associate Director in the summer of 1969, and Scott C. Daubin took on the lead role in the design of such a system. This Contract N00014-71-C-0057; NR QLR 047 became active on 17 September 1970 and continued until 30 September 1978.

E. Hays returned from La Spezia in the summer of 1971, just as Scott Daubin was leaving for the University of Miami, and became principal investigator on the contract. Two units were ready for initial deployment and testing and Daubin supervised these tests. LRAPP(Long Range Acoustic Propagation Project) had been formed and H. Aurand was the head. He returned to NOSC (current name) and Roy Gaul took over LRAPP.

The initial tests demonstrated the feasibility of the system, but the experience showed some physical design changes were desired for launching and recovery. Gaul arranged for a group from Texas Instruments (A. Kirst) to work with WHOI on an intensive repackaging design and five ACODACS (Acoustic Data Capsule) were eventually built.

These were deployed in many parts of the world by WHOI and TI and were used to record not only ambient noise but also signals from CW sources and explosives. The first truly successful measurements were made in the summer

and fall of 1972 and some of the units are currently in use as of this writing.

The ACODAC program has had an impact upon our knowledge of ambient noise and long range propagation including bottom loss. Independent of this contract they have been used by PME-124 in the assessment of certain surveillance systems concepts with success.

Description of the ACODAC System

The ACODAC system has been dynamic during the eight years of its existence. Starting out as a seven track system, some of the units were modified to fourteen track units. The hydrophones, their mountings and preamps were changed several times depending upon the particular application. Recent deployments have used Kevlar line with twisted conducting pairs laid in the line. The following is a resume of a typical system as of January 1974 and contains the basics. More information is available in the following documents:

The ACODAC System, Daubin, H. Berteaux, Bitterman, D., Boutin, P. and Kallio, P., November 1972, WHOI Technical Report 72-87.

ACODAC Operations and Maintenance Manual, Texas Instruments Service Group, 22 March 1973.

The ACODAC Ambient Noise System, Bitterman, D., March 1975, WHOI Technical Report 75-20.

ACODAC System

1. Introduction

The Acoustic Data Capsule (ACODAC) system is designed to acquire long time series recordings of acoustic signals at a number of depths simultaneously throughout the water column in the deep ocean. Data

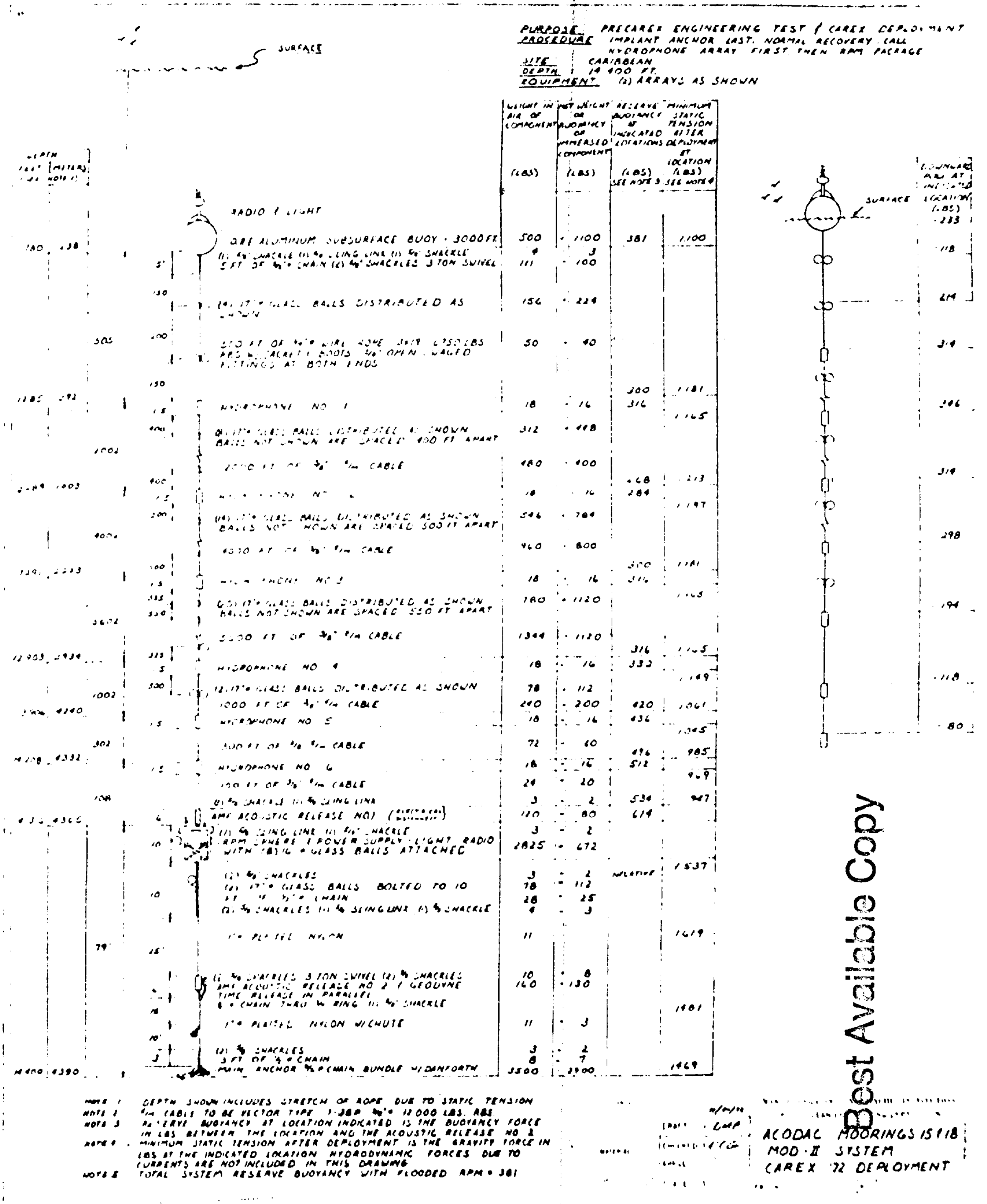
acquisition is completely automatic, requiring the intervention of neither men nor ships. Measurement depths are selectable. Sample intervals and system turn-on time are selectable. The system is deployable from a number of platforms and is therefore not tied to a particular ship. It is normally an anchor last deployment system.

2. ACODAC System Description

Figure 1 shows a typical configuration for an ACODAC array. The ACODAC systems record data from six hydrophones distributed throughout the water column. The bandwidth of the system extends from 5 Hz to 400 Hz, and the maximum total recording time is 10 2/3 days. The recording duty cycle range is 1"1 to 30:1 in selectable integral ratios; the recording time per cycle is selectable from 1 to 128 minutes.

Figure 2 is a block diagram of the data acquisition system. The data sub-system consists of all those elements which transform the acoustic pressure signal in the ocean into a magnetic recording within the instrument pressure vessel (IPV). These include the hydrophones with their preamplifiers, the transmission functions of the interconnecting cable, the IPV data amplifiers with their gain control and error detection circuitry and the magnetic recorder. Hydrophone preamplifier power is supplied via the signal lead from the IPV power supply. The command and control circuitry and the master clock circuitry which control the sampling program and interact with the human operator at the surface via acoustic telemetry also are part of the data acquisition sub-system. GMT time is recorded on the time code track of the tape recorder.

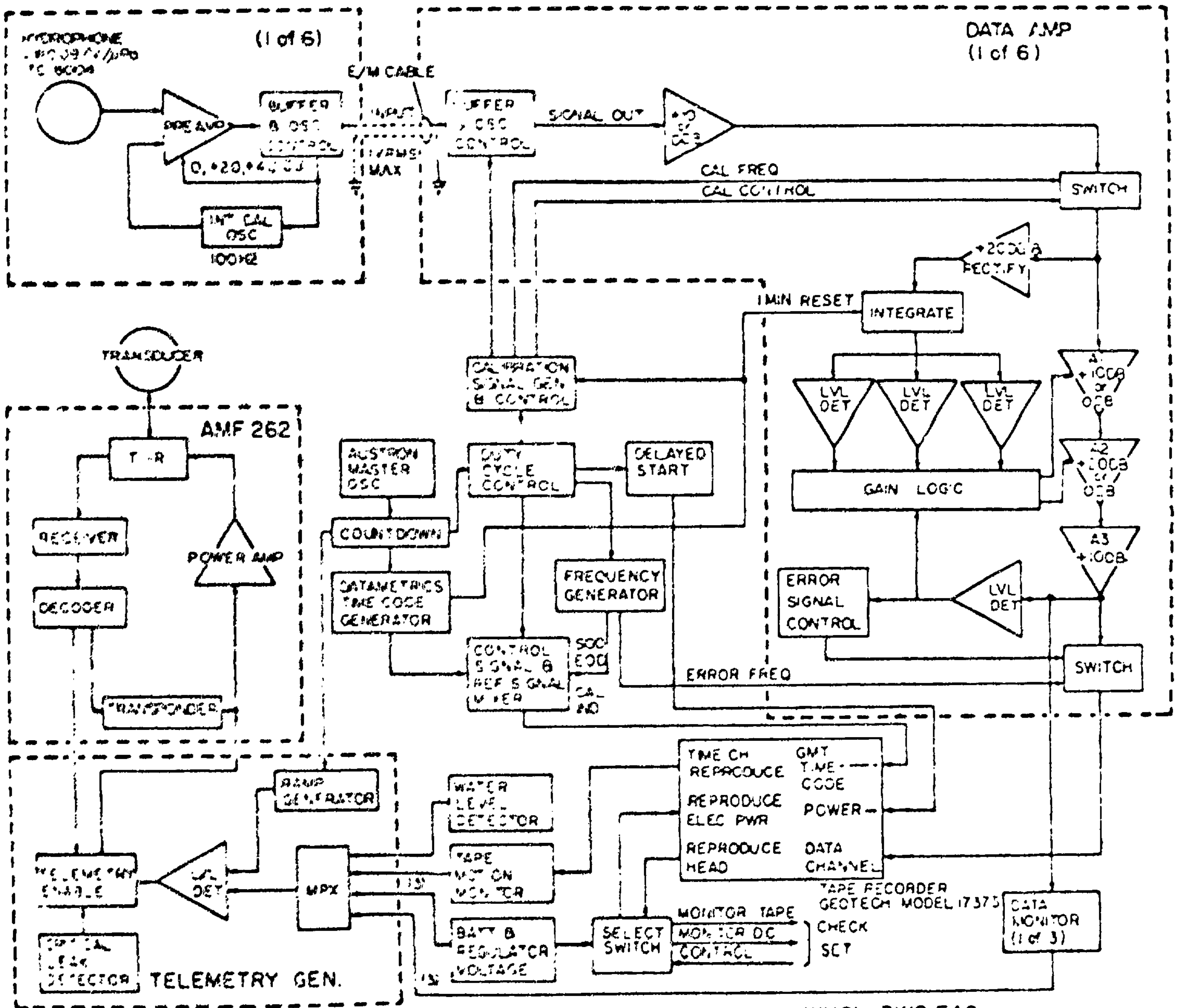
The tape recorder is the heart of the system. It is a low-speed, (15/160" sec) direct recording unit with IRIG-compatible tape track configuration.



Typical ACODAC Mooring Configuration

Figure 1

ACODAC ELECTRONICS BLOCK DIAGRAM (MOD I)

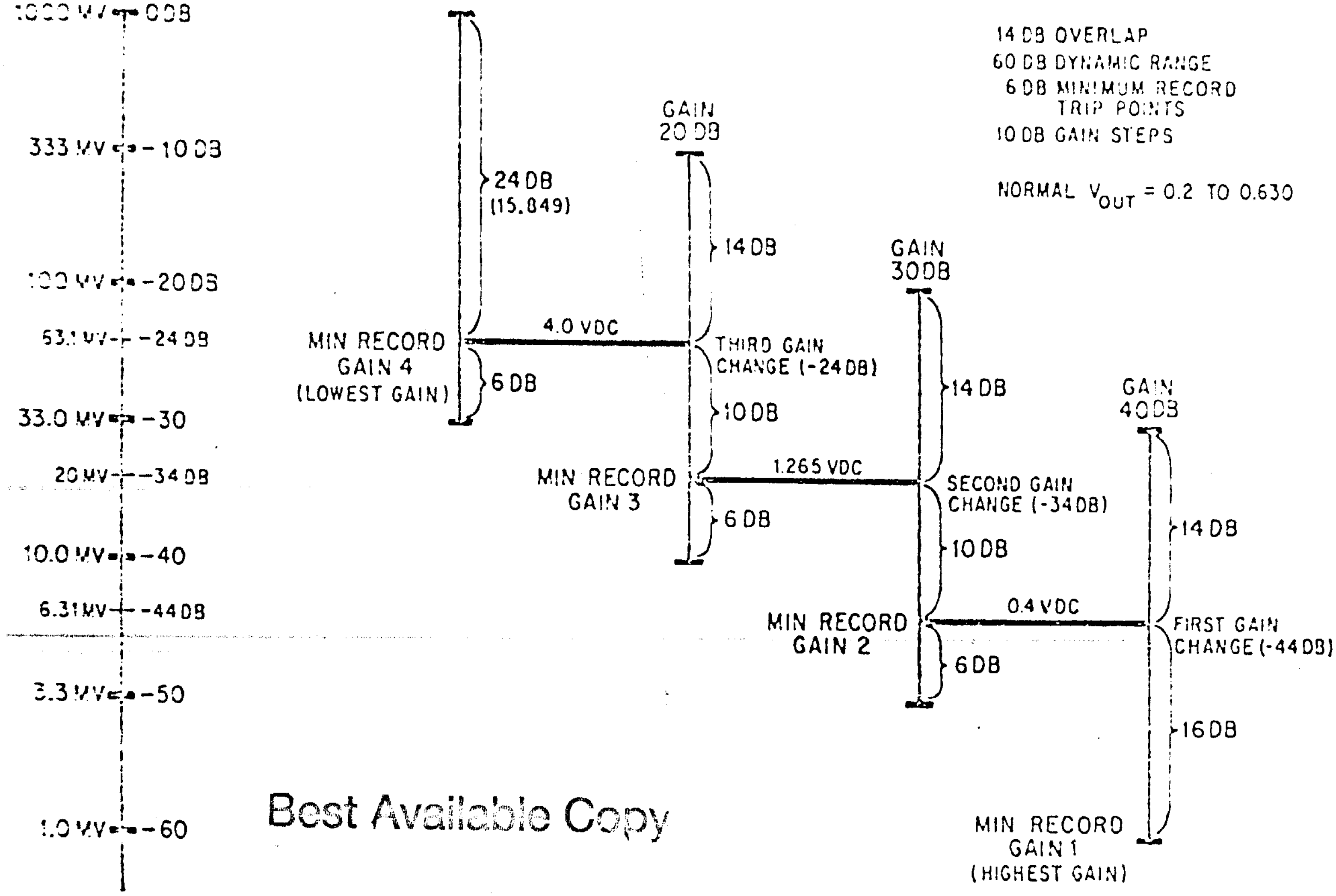


This enables the data reduction to be performed with any high-quality playback recorder at increased speed. The recorder is chosen for its long-term recording capability in terms of the time-bandwidth product, low power drain and general suitability for field use. The command and control system includes a time-code generator, a multiple-frequency generator, a calibration-signal generator, the tape recorder motor-control circuitry, and a master clock.

The electronics of an American Machine and Foundry Company (AMF) Model 262 acoustic transponder/release system are also incorporated into the sphere and are tied to an acoustic telemetry system. This provides a means for relocating the system for retrieval, releasing the sphere, and checking the status of the unit after deployment.

The data amplifiers interface the hydrophones with the tape recorder and incorporate an automatic gain control circuit to compensate for differences in dynamic range between the hydrophones and the recorder. They also provide inputs for injecting calibration and error marker signals, and allow for pre-recording equalization as required.

Automatic gain switching matches the acoustic signal to the dynamic range of the tape recorder, about 30 db. Figure 3 summarizes the gain switching levels. In the absence of transients which overload the tape recorder, the average level of the acoustic signal during each minute is used to select the gain state for the next minute. When a transient signal strong enough to overload the tape recorder is detected and overload-error signal (0.175 sec tone burst of 75 Hz and 200 Hz) is substituted for the acoustic signal being recorded. During processing, detection of the overload-error signal causes the data to be rejected. An overload causes the gain state to be dropped to a lower level, as shown in Figure 3. for



GAIN SWITCHING LEVELS

Figure 3

a preselected time interval ranging from one to nine minutes. At the end of this interval the gain returns to a state determined only by the averaging circuitry, the action of the overload detector being inhibited during this time. Gain is controlled by the time code generator and occurs only at the minute marks of the time code.

In order to determine the actual level of the playback signals in performing data reduction, a calibration signal is recorded on the tape periodically in palce of the data, (see Figure 2). The calibration signal consists of a composite of two tones, 50 Hz and 200 Hz, which is stepped through four different amplitudes. In addition, the calibration signal generator also outputs logic controls to override the automatic gain control of the data amplifiers and step their gain in sequence with the amplitude of the calibration signal. The four amplitudes correspond to the four gain ranges of the data amplifiers so that the resulting output signal is constant. The calibration is applied for five minutes every six hours except when the recorder is on the off portion of the duty cycle, in which case it waits until the recorder is turned on. At the end of the five minute calibration, a 100 Hz calibrated signal generated in the preamplifier housing is turned on for two minutes at the input to the hydrophone preamplifier, in series with the hydrophone.

Other ACODAC characteristics are as follows:

.	Hydrophone sensitivities	-179 db/volt/uPa
.	Preamp gain, selectable before deployment	0, 20, 40 db
.	Fixed amplifier gain, selectable before deployment	0, 10 db
.	Switching amplifier gain, controlled by one minute average or overload	10, 20, 30, 40 db
.	Preamp noise referred to input, in 1-300 Hz band	1.4 microvolt rms
.	Preamp level	1.7 volt rms max
.	Overload to data amplifier	1 volt rms
.	Overload to tape recorder	3.16 volt rms

Calibrations are run on preamp and hydrophones by the Naval Research Laboratory, Underwater Sound Reference Division, Orlando, Florida. Transfer function from preamp to play-back are measured in the laboratory for each 1/3 octave band. Two calibration signals (50,200 Hz) are stepped through all gain stages every six hours to check system stability.

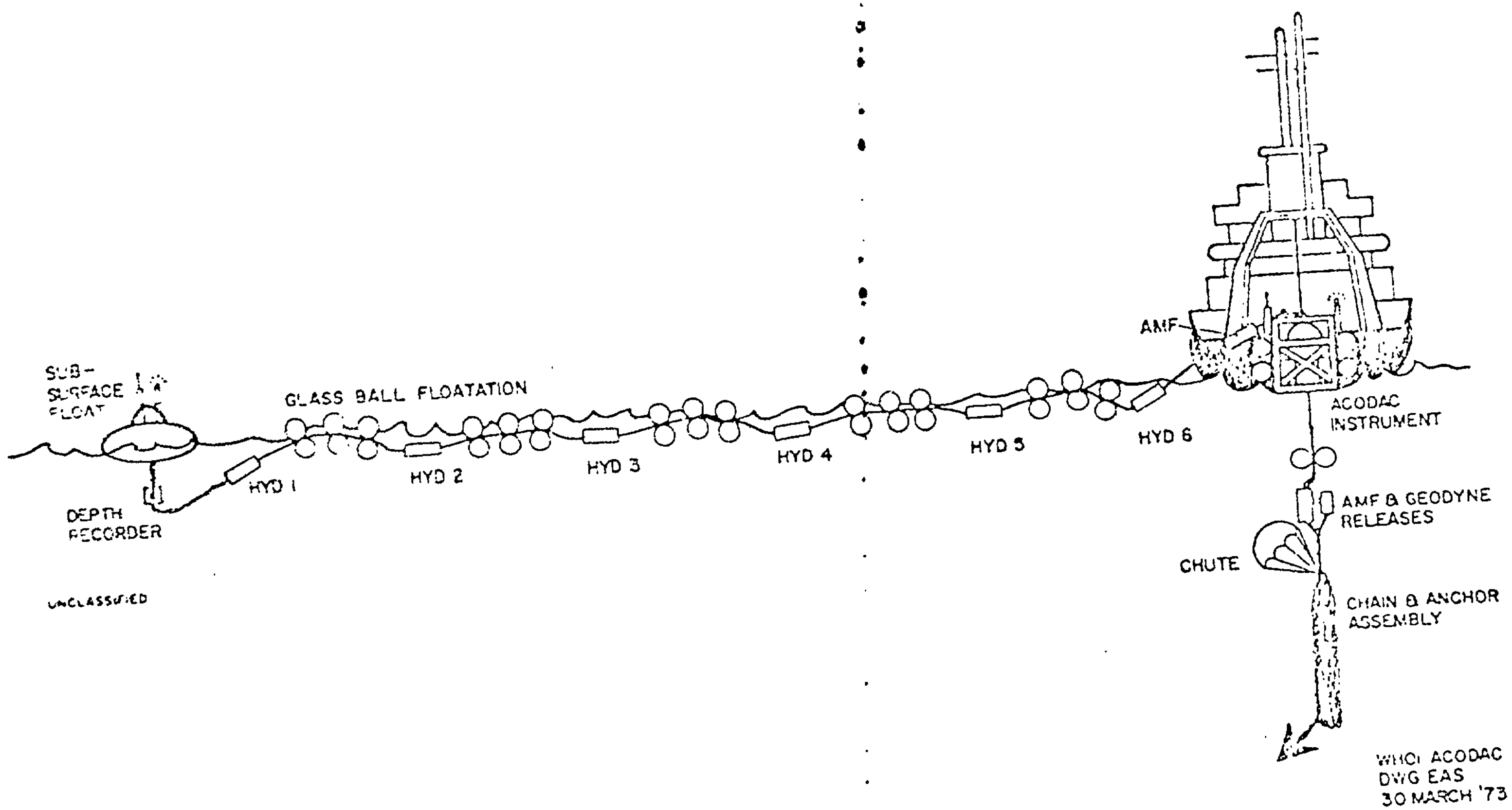
3. <u>Deployment and Retrieval of the ACODAC System</u>

As shown in Figure 1, the ACODAC system consists of:

- A subsurface float having a radio transmitter and xenon flash lamp
- A depth sensor beneath the float
- An array of 6 hydrophones along an electromechanical cable
- Glass ball flotation along the cable
- An AMF acoustic release below the hydrophone array
- The instrument pressure vessel (IPV) containing the electronics, recording, and telemetry
- A power supply
- An AMF acoustic release below the IPV
- A Geodyne time release (or another AMF acoustic release)
- The anchor assembly.

The subsurface float is fitted with a radio transmitter and flash lamp is deployed first over the stern, (see Figure 4). The usual deployment has the ship going downwind or upwind at from o to 1½ knots. An array of 15,000 feet normally takes 4-6 hours to deploy; therefore, the ship starts nine miles from the selected deployment site.

The No. 1 hydrophone is connected to the cable and then checked when in the water. Next follows the flotation and cable until No. 2 hydrophone is connected and so on until No. 6 hydrophone is deployed. Next follows the AMF acoustic release and the IPV. Two radio transmitters and a flasher light are installed on the IPV. Another AMF acoustic release and a Goedyne time release are connected below the IPV. The last unit on the line is the anchor assembly, consisting of approximately 3000 pounds of anchor chain, a chute, and a Danforth anchor. The anchor assembly is strung out and supported by an auxiliary rope until the IPV is ready to be deployed.



ACODAC Launching Technique

Figure 4

Synchronization time is inserted prior to launch. For accurate geographical positioning it is customary to arrange the launches to coincide closely to satellite passes.

The ACODAC system is retrieved by calling for the release of the AMF release at the bottom end of the array of six hydrophones. When the subsurface float surfaces and is located, the the IPV is called for release. When the IPV surfaces, it is taken aboard first - this usually takes 20-30 minutes. Next the subsurface float is taken aboard, then hydrophone No.1 and so on. This latter operation normally takes about three hours.

4. Hydrophone Depth Selection

Hydrophone depths are selected with the aid of archival sound velocity profile data supplied by AESD. One phone is placed below the expected critical depth, one above the critical depth, one near the deep sound channel axis and one at a depth corresponding as closely as possible to the depth of nearby bottomed arrays. The two remaining hydrophones will sample the upper sound channel, where present, or additional points in the deep sound channel. This arrangement will allow a comparison of S/N ratios at mid-water and bottom locations.

ACODAC Data Processing

The original purpose of the ACODAC System was to determine ambient noise levels in the frequency range from 10 to 300 Hz. Available to supply this were the six (13) channels of analogue recording with a corresponding time code channel so that the noise level could be related to the time. An analysis method was devised based around an HP 2100 computer. This is completely described in

The ACODAC Data Processing System, C. D. Tollios, September 1973, WHOI Technical Report 73-59.

A short description follows. The analogue data from one track, is passed through a set of 15 1/3 octave filters covering the ACODAC recording range. The average power level in each band is sampled digitally five times a minute. This is stored on a digital tape, with gain levels, time and the transfer function of the system. Calibration signals are included regularly. This tape is then processed to produce plots of numerical output of the ambient noise as a function of time.

Some CW signals were analyzed in the same manner by using narrow band filters clustered around the expected arrival frequency rather than the 1/3 octave filters.

Some data from explosive sources was analyzed from the ACODAC tapes by WHOI using a method developed for the NEAT 2 exercise. The analogue ACODAC tapes were replayed onto FM tapes and after 1/3 octave filtering digitized around the shot arrival times. These sequences were squared and a running integral trace displayed on a display and hold scope. The increase in level due to the integration over the shot duration is measured and related to gain settings, and to the transfer function of the system to obtain the energy of the arrival.

Most of the LRAPP exercises involved groups from several organizations, and the completion and issuing of the reports was assigned to one group. Therefore most of the ACODAC data processed by Woods Hole appears in reports issued by someone else.

Technical Services

In addition to the major effort in designing developing and operating the ACODAC's considerable work was done for LRAPP in related fields.

Roy Rather of Commercial Engineering, under subcontract to this contract served as an advisory engineer in a variety of undertakings. Mr. Rather's specialty is in the design and construction of systems for handling

and towing heavy objects underwater. He participated heavily in the VIBROSEIZE program, in the design of winches for handling arrays, and in the layout and modifications to the many ships used by the LRAPP program.

Paul Boutin, who is an expert in the launch and recovery of moored systems and their design, has worked with Texas Instruments in advising them about the systems that they have set for LRAPP. He also participated in the layout of ships used for ACODAC deployment.

David Bitterman, who did the major electronic design for ACODAC, worked with people at Texas Instruments in the design of the follow-on PAR systems, which were a second generation ACODAC.

Jess Stanbrough worked with the many organizations involved in the LRAPP program, advising them about navigation methods and techniques, and supplying them with oceanographic data.

E. Hays was involved in the writing of summary reports for LRAPP exercises and participated in many planning meetings for LRAPP exercises.

Moored Sources

An important contribution of the Woods Hole group to the LRAPP program was the introduction of moored sources to the program. These sources, originally developed by D. Webb of Woods Hole to measure ocean currents, are self-contained sources in the frequency range 150 to 400 Hz that can be placed on a mooring to act as a reference source for long periods. They can operate in the Continuous Wave mode, be pulsed at regular intervals, or can have coded signals. The source level is about 175 db referenced to a micropascal. Under this contract several sources have been constructed and used in the LRAPP program. When used by other organizations than Woods Hole, D. Webb and P. Boutin have acted as advisors to the users.

Documents that arose directly or indirectly from this contract:

Anderson, A. L., "CHURCH ANCHOR Explosive Source (SUS) Propagation Measurements" (U), ARL, University of Texas, ARL-TR-74-53, December 1974. Confidential.

Arthur D. Little, Inc., Preliminary Analysis of ACODAC Measurements near Madeira on 13-16 October 1971 (U), Report No. 456-372, 31 March 1972. Secret.

B-K Dynamics, Inc., "Blake Test and ACODAC Data Processing", Final Technical Report TR-3-182, 31 August 1973. Unclassified.

B-K Dynamics, Inc., "Analysis of ACODAC Measurement Accuracy", Report No. TR-3186, March 1974. Unclassified.

B-K Dynamics, Inc., "WESTIANT Phase I Data Summary" (U), Long Range Acoustic Propagation Project, (No report number), March 1975. Confidential.

Daubin, S. C. et al, "The ACODAC System", Woods Hole Oceanographic Institution, Report No. WHOI-72-87, November 1972. Unclassified.

Daubin, S. C. "Transmission Loss of Low Frequency Underwater Sound in the Cayman Trough (CHURCH GABBRO Technical Notes)(U), Rosenstiel School of Marine and Atmospheric Science, University of Miami, Technical Report No. CMC-18540, June 1974. Confidential.

Daubin, S. C., "Ambient Noise in the Northwest Caribbean Sea (CHURCH GABBRO Technical Note)", Rosenstiel School, University of Miami, Technical Report No. HCI-CMC-18343. Confidential.

Daubin, S. C. and Nardell, John, "Blake Test Synopsis Report", Hydrospace-Challenger Inc., (No report number), August 1973. Unclassified.

Ellis, G. E., Plemons, T. D., Hampton, L. D. and Shooter, J. A., "ARL Preliminary Data Analysis Time ACODAC System", University of Texas, ARL Report No. ARL-TM-73-11, 20 July 1973. Unclassified.

Ellis, G. E., Plemons, T. D., Hampton, L. D. and Shooter, J. A., "Analysis of the Blake Test ACODAC Data", ARL University of Texas, Report No. ARL-TM-73-12, 20 July 1973. Unclassified.

Grolman, Richard O., Mellenbruch, Larry Y., and Sawicki, Felix J., "Special Hardware for ARL Analysis of ACODAC Data", ARL University of Texas, Report No. ARL-TM-74-12, 14 March 1974. Unclassified.

Katz, Eli Joel, "The Sound Channel Axis in the Western Mediterranean", Woods Hole Oceanographic Institution, Technical Report, Reference 71-26, May 1971. Unclassified.

Maury Center for Ocean Science, "CHURCH GABBRO Synopsis Report" (U), MC Report 012, February 1973. Confidential-No Forn.

Maury Center for Ocean Science, "Summary of the SQUARE DEAL Synopsis Report" (U), MC Report 0014, February 1974. Secret.

Mitchell, Stephen K. and Plemons, Terry D., "Quality Control Analysis of SUS Processing from ACODAT Data' (U), ARL University of Texas, Report No. ARL-TM-73-42, December 20, 1973. No Forn.

Mitchell, Stephen K. (Editor) et al, "SQUARE DEAL Explosive Source (SUS) Propagation Measurements (U), ARL University of Texas, Report No. ARL-TM-76-37-19, July 1976 (Preliminary Draft). Confidential.

Tollios, C. D., "The ACODAC Data Processing System", Woods Hole Oceanographic Institution, Report No. WHOI-73-50, September 1973. Unclassified.

Xonics, Inc., SQUARE DEAL Environmental Acoustic Summary (Draft) (U), Control No. 1019, 20 September 1975. Secret.

Hays, E., "Ambient Noise Near Madeira, August 1972 (U), Woods Hole Oceanographic Institution, Technical Report WHOI-78-35. Confidential.

Bitterman, D. S., "The ACODAC Ambient Noise System", Woods Hole Oceanographic Institution, WHOI Technical Report No. 75-20. Unclassified.

Miller, A. R., "Distribution of Temperature, Salinity and Sound Velocity in the Western Ionian during Spring 1968", Woods Hole Oceanographic Institution, Technical Report WHOI No. 72-5.

Texas Instruments, "The ACODAC Operations and Maintenance Manual", (Services Group, 22 March 1973.

SUMMARY OF ACODAC DEPLOYMENTS AND DATA - PARTICIPATION BY WOODS HOLE OCEANOGRAPHIC INSTITUTION

DEPLOYMENT NO.	SHIP	DATE DEPLOYED	DATE RECOVERED	GENERAL AREA	LATITUDE	LONGITUDE
1	KNORR	5-16-71	5-18-71	Cape Cod	39°49'	70°17'
2	NORTH SEAL	8-8-71	8-20-71	Bermuda	32°17'	64°29'
3	NORTH SEAL	10-13-71	10-18-71	Madeira	33°22'	19°41'
4	NORTH SEAL	10-11-71	10-18-71	Madeira	33°29'	19°36'
5	NORTH SEAL	11-2-71	11-25-71	Ionian Basin	36°17'	17°13'
6	NORTH SEAL	11-1-71	11-25-71	Ionian Basin	36°15'	17°36'
7	NORTH SEAL	6-20-72	6-24-72	Bermuda	35°45'	69°55'
8	NORTH SEAL	6-21-72	6-25-72	Bermuda	35°51'	69°51'
9	NORTH SEAL	8-3-72	8-11-72	Madeira	33°32'	19°46'
10	NORTH SEAL	8-24-72	9-9-72	Ionian Basin	36°25'	17°28'
11	NORTH SEAL	8-25-72	9-9-72	Ionian Basin	36°20'	17°37'
12	NORTH SEAL	10-9-72	10-18-72	Bermuda	31°06'	66°22'
13	NORTH SEAL	10-10-72	10-18-72	Bermuda	31°11'	66°32'
14	NORTH SEAL	10-29-72	10-30-72	Miami	26°07'	78°28'
15	NORTH SEAL	11-10-72	11-18-72	Eleuthera	26°38'	76°12'
16	NORTH SEAL	11-11-72	11-17-72	Eleuthera	26°40'	76°12'
17	NORTH SEAL	11-28-72	12-9-72	Caribbean	17°35'	86°04'
18	NORTH SEAL	11-26-72	12-30-72	Caribbean*	20°00'	85°59'
19	NORTH SEAL	11-30-72	12-15-72	Caribbean	18°49'	79°52'
20	CHAIN	7-24-73	8-11-73	NE Atlantic	54°52.3'	28°50.7'
21	CHAIN	7-25-73	8-7-73	NE Atlantic	51°30'	19°38'
22	CHAIN	7-27-73	8-11-73	NE Atlantic	55°12'	13°33'
23	CHAIN	8-19-73	8-24-73	NE Atlantic	51°30'	19°37'
24	CHAIN	9-3-73	9-22-73	NE Atlantic	60°25'	19°04'
25	CHAIN	9-6-73	10-4-73	NE Atlantic	54°52'	28°49'
26	CHAIN	8-20-74	8-25-74	Eleuthera	27°00'	72°35'
27	CHAIN	9-7-74		Eleuthera	26°26'	74°03'
28	CHAIN	9-8-74		Eleuthera	26°24'	74°01'
29	CHAIN	10-2-74	10-14-74	Bermuda	28°18'	64°03'
30	CHAIN	10-3-74	10-13-74	Bermuda	28°17'	64°06'
31	CHAIN	10-23-74	11-8-74	Bermuda	28°29'	57°05'
32	CHAIN	10-25-74	11-8-74	Bermuda	28°28'	57°06'
33	CHAIN	11-12-74	11-14-74	Bermuda	32°25'	64°17'
34	CHAIN	7-17-75	7-18-75	Bermuda	31°39'	64°48'
35	CHAIN	7-21-75	7-22-75	Bermuda	31°39'	64°49'
36	CHAIN	7-24-75	7-26-76	Bermuda	34°01'	68°58'
37	CHAIN	11-3-75	11-11-75	NE Atlantic	40°35'	62°12'
38	CHAIN	11-3-75	11-11-75	NE Atlantic	40°21'	61°44'
39	CHAIN	11-4-75	11-12-75	NE Atlantic	40°10'	62°12'
40	CHAIN	11-6-75	11-23-75	NE Atlantic	40°32'	61°54'
41	CHAIN	11-16-75	11-23-75	NE Atlantic	40°23'	62°12'
42	CHAIN	11-16-75	11-23-75	NE Atlantic	40°10'	62°02'

*Recovered off Miami

SUMMARY OF ACODAC DEPLOYMENTS AND DATA -
PARTICIPATION BY WOODS HOLE OCEANOGRAPHIC INSTITUTION

DEPLOYMENT NO.	WATER DEPTH (m)		HYDROPHONE DEPTHS (m) (Corrected)
1	1148		69, 130, 1136
2	3500		3049, 3115, 3181, 3247, 3313, 3378
3	4470		1666, 1727, 1788, 2641, 4104, 4378
4	4595		1706, 1772, 1838, 1904, 1970, 2035
5	3365		135, 939, 1000, 1061, 1964, 3245
6	3420		1908, 1974, 6906, 2106, 2172, 2237
7	4660		0320, 2455, 3066, 3678, 4289, 4596
8	4802		1680, 22[illegible] 2598, 3309, 4431, 4738
9	4792		1672, 2283, 2589, 3201, 4402, 4728
10	3431		301, 333, 944, 1556, 2167, 2779
11	3567		470, 475, 842, 1242, 2161, 3381
12	4938		2243, 2854, 3467, 3493, 3531, 4771
13	4853		2158, 2769, 3382, 3446, 4686
14	882		402, 576, 608, 640, 667, 700
15	4700		702, 1413, 2533, 4244, 4550, 4642
16	4709		707, 1319, 2541, 4278, 4557, 4650
17	4506		508, 1119, 2341, 4053, 4358, 4450
18	4593		595, 1205, 2426, 4137, 4443, 4535
19	4846		966, 1576, 2757, 4410, 4715, 4806
20	3045		558, 712, 844, 1455, 1944, 2860
21	3780		387, 846, 1450, 2066, 2777, 3289
22	2805		585, 715, 1082, 1504, 1810, 2467
23	3790		398, 1009, 1376, 1834, 2445, 3147
24	2546		406, 772, 1078, 1445, 1512, 2422
25	3060		606, 760, 890, 1501, 1960, 2876
26	5000		1300, 3300, 3700, 4400, 4600, 4600
27	4650	Beacon	1600, 1602, 1604, 1608, 1616, 1632
28	4650	Beacon	1600, 1602, 2826, 3480, 3937, 4550
29	5328		3628, 4628, 4828, 5028, 5298, 5328 Bottom
30	5344		1444, 3444, 4044, 4744, 4944, 5314
31	5298		3411, 4598, 4798, 4998, 5268, 5298 Bottom
32	5349		1521, 3520, 4049, 4749, 4949, 5319
33	4030		540, 1760, 2370, 2823, 3890, -
34	4444		4280
35	4400		4240
36	5310		5170
37	4795		4770, 4776
38	4860		4835, 4841
39	4945		4920, 4926
40	4890		4865, 4871
41	4860		4835, 4841
42	4985		4960, 4966

SUMMARY OF ACODAC DEPLOYMENTS AND DATA - PARTICIPATION BY WOODS HOLE OCEANOGRAPHIC INSTITUTION

DEPLOYMENT NO.	DATA WINDOW	GENERAL QUALITY OF DATA TAPE
1	Note 1	Generally good; system test only.
2	Note 1	Reasonable; time code/gain-state generator problem.
3	Note 1	Good data from 4 phones only.
4	Note 1	Good data from 4 phones only.
5	Note 1	System recalled - no data.
6	Note 1	One minute only of data.
7	Note 2	Some good data; high currents.
8	Note 2	Some good data; high currents.
9	Note 2	Good data from all hydrophones.
10	Note 2	Good data from all hydrophones.
11	Note 2	Good data from 5 hydrophones, possibly the 6th.
12	Note 2	Looks reasonable; noisy spot, currents.
13	Note 2	Looks reasonable; noisy spot, currents.
14	Note 3	Looks noisy, some data.
15	Note 3	Defective hydrophones. Meaningless signals.
16	Note 3	Some data on all hydrophones; high currents.
17	Note 3	Good data from 5 hydrophones.
18	Note 3	Possibly 2 or 3 hydrophones useful.
19	Note 3	Good data from all hydrophones.
20	Note 4	Good data from 5 hydrophones, 10% on 6th.
21	Note 4	Good data from 4 hydrophones, 50% on 5th and 20% on 6th.
22	Note 4	Good data from 5 hydrophones, 50% on 6th.
23	Note 4	Good data from all hydrophones, best of SQUARE DEAL.
24	Note 4	Good data from all hydrophones.
25	Note 4	Good data from all hydrophones.
26		
27		
28		
29		≈ 50% good data. Tape recorder problems.
30		≈ 15% good data. Connector leakage.
31		≈ 95% good data.
32		≈ 20% good data. Tape recorder problems.
33		
34		
35		
36		
37		≈ > 95% 6 days.
38		≈ > 95% 6 days.
39		≈ > 95% 7 days.
40		≈ > 95% 2 days only.
41		≈ >95% one day only.
42		≈ >95% 6 days.

Notes:
1. Gain shift to match ambient noise - one minute average.
2. Same as 1 then shift to 10 db lower gain on overload signal and record 3 minutes.
3. Same as 1 then shift to 10 db lower gain on overload signal and record 2 minutes.
4. Same as 1 then shift to 20 db lower gain on overload signal and record 5 minutes.

SUMMARY OF ACODAC DEPLOYMENTS AND DATA - PARTICIPATION BY WOODS HOLE OCEANOGRAPHIC INSTITUTION

DEPLOYMENT NO.	DISPOSITION	DATA REDUCTION
1		Wideband Brush plots; no further reduction.
2		Wideband Brush plots; further analysis of marginal value.
3		Partially reduced and reported (ADL Report 4560372, 31 Mar. 1972).
4		Same as 3.
5		No data.
6		No data.
7	WHOI	Wideband Brush plots; no further reduction. System checked.
8	WHOI	Wideband Brush plots; no further reduction. System checked.
9	WHOI	All phones, wideband and 50 Hz 1/3 octave Brush plots, 1/3 octave bands (15) digitized, time vs level plots, 6 hr statistics, 10 min avgs. TL shots.
10	BKDynamics	Same as 9 plus 130 Hz cw by hand.
11	BKDynamics	Same as 10 minus cw.
12	WHOI	Same as 9 minus statistics and shots.
13	WHOI	Same as 12.
14	UMiami	All phones, wideband and 50 Hz 1/3 octave plots.
15	UMiami	No reduction - meaningless.
16	UMiami	All phones 50 Hz 1/3 octave plots, some wideband.
17	UMiami	Same as 9 plus selected time windows.
18	UMiami	All phones wideband Brush plots - wandering array.
19	UMiami	Same as 17.
20	Xonics	All phones, wideband and 50 Hz 1/3 octave Brush plots, 1/3 octave bands (15) digitized, time as level plots, statistics.
21	Xonics	Same as 20.
22	Xonics	Same as 20.
23	Xonics	Same as 20.
24	Xonics	Same as 20.
25	Xonics	Same as 20 plus TL shots Hyd. 1,3,5 ARL comparison.
26		
27		
28		
29	UMiami	
30	UMiami	
31	UMiami	
32	UMiami	
33	UMiami	
34	Westinghouse	Mooring GE array test - not good -array did not deploy.
35		GE array test and calibration at calibration site.
36	GE/NADC	Looks good - excellent data
37	NADC	
38	NADC	
39	NADC	
40	NADC	
41	NADC	
42	NADC	

SUMMARY OF ACODAC DEPLOYMENTS AND DATA -
PARTICIPATION BY WOODS HOLE OCEANOGRAPHIC INSTITUTION

DEPLOYMENT NO.	PURPOSE FOR DEPLOYMENT	MOD	PHONES	FREQ. RANGE	DUTY CYCLE
1	System Test-SCD	IA1	WHOI, ITC 8004	10-300	Continuous
2	Measurement Program-SCD	IA2	WHOI, ITC 8004	10-300	Continuous
3	Measurement Program-SCD	IA2	WHOI, ITC 8004	10-300	Continuous
4	Measurement Program-SCD	IA1	WHOI, ITC 8004	10-300	Continuous
5	IOMEDEX-SCD	IA2	WHOI, ITC 8004	10-300	Continuous
6	IOMEDEX-SCD	IA1	WHOI, ITC 8004	10-300	Continuous
7	Madeira-pilot-JHS	IA1	UM, ITC 8020	10-300	Continuous
8	Madeira-pilot-JHS	IA2	UM, ITC 8020	10-300	Continuous
9	EASTLANT-JHS	IA2	UM, ITC 8020	10-300	Continuous
10	TASSRAP-EEH/JHS	IA2	UM, ITC 8020	10-300	Continuous
11	TASSRAP-EEH/JHS	IA1	UM, ITC 8020	10-300	Continuous
12	Measurement Program-JHS	IA2	UM, ITC 8020	10-300	Continuous
13	Measurement Program-JHS	IA1	UM, ITC 8020	10-300	Continuous
14	System Test-SCD	IIA4	UM, ITC 8020	10-300	Continuous
15	System Test-SCD	IIA3	Westinghouse	10-300	Continuous
16	System Test-SCD	IA2	UM, ITC 8020	10-300	Continuous
17	CHURCH GABBRO-SCD	IA1	UM, ITC 8020	10-300	Continuous
18	CHURCH GABBRO-SCD	IIA3	Westinghouse	10-300	Continuous
19	CHURCH GABBRO-SCD	IIA4	UM, ITC 8020	10-300	Continuous
20	SQUARE DEAL-EEH/RTN	IIA5	WHOI, ITC 8004A	5-400	Continuous
21	SQUARE DEAL-EEH/RTN	IA1	WHOI, ITC 8004A/ 8032	5-400	Continuous
22	SQUARE DEAL-EEH/RTN	IA2	WHOI, ITC 8032/ 8004A	5-400	Continuous
23	SQUARE DEAL-EEH/RTN	IA1	whoi, ITC 8032/ 8004A	5-400	Continuous
24	SQUARE DEAL-EEH/RTN	IA1	WHOI, ITC 8004/ 8032	5-400	Continuous
25	SQUARE DEAL-EEH/RTN	IA2	WHOI, ITC 8032/ 8004	5-400	Continuous
26	Kevlar Test-RTN	IA2	WHOI		Continuous
27		IA1	WHOI, ITC 8004/ Beacon		Continuous
28		IA2	WHOI, ITC 8004/ Beacon		Continuous
29	WESTLANT-Phase 1	IA1	ITC 1010A		Continuous
30	WESTLANT-Phase 1	IA2	WHOI, ITC 8032		Continuous
31	WESTLANT-Phase 2	IA2	WHOI, ITC 1010A		Continuous
32	WESTLANT-Phase 2	IA1	WHOI, ITC 8032		Continuous
33	WESTINGHOUSE-Array Test	IA2	WEST-WX-VERAY-1		Continuous
34	MSS-Test F	IA2	GE-Phones		Continuous
35	MSS-Test F	IA2	GE-Phones		Continuous
36	MSS-Test F	IA2	GE-Phones		Continuous
37	MSS/FVT	IA1	OMNI-Pressure Gradient		Continuous
38	MSS/FVT	IA2	OMNI-Pressure Gradient		Continuous
39	MSS/FVT	IIA5	OMNI-Pressure Gradient		Continuous
40	MSS/FVT	IA2	OMNI-Pressure Gradient		Continuous
41	MSS/FVT	IA1	OMNI-Pressure Gradient		Continuous
42	MSS/FVT	IIA5	OMNI-Pressure Gradient		Continuous

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2. The LRAPP documents listed in enclosure (1) have been downgraded to UNCLASSIFIED and have been approved for public release. These documents should be remarked as follows:

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Report Number	Personal Author	Title	Publication Source (Originator)	Pub. Date	Current Availability	Class.
Unavailable	Unavailable	SELF-TENSIONING ACOUSTICAL HORIZONTAL LINE ARRAY (SPRAY) DATA ANALYSIS. FINAL REPORT OF BEARING STAKE TESTS JANUARY THRU MARCH 1977. VOLUME IVB. DATA POINTS 10, 11 AND 12 RAW DATA	Sanders Associates, Inc.	790109	ADC017579	U
ARLTR7924	Mitchell, S. K., et al.	ANALYSIS OF ACOUSTIC BOTTOM INTERACTION IN BEARING STAKE (U)	University of Texas, Applied Research Laboratories	790223	ADE001369; NS; ND	U
TIU1886502F	Eichenberger, D.	REPORT FOR CHURCH STROKE II OCEANOGRAPHIC SERVICES	Texas Instruments, Inc.	790326	ADB036751; ND	U
Unavailable	Unavailable	FINAL REPORT, 1 NOVEMBER 1976-31 DECEMBER 1978	Xonics, Inc.	790430	ADB037987	U
Unavailable	Mitchell, T. M.	PREMOBILIZATION OF R/V INDIAN SEAL	Texas Instruments, Inc.	790531	ADB039703	U
Unavailable	Hays, E. E.	ACODAC AMBIENT NOISE PROGRAM	Woods Hole Oceanographic Institution	790601	ADB040404	U
LRAPPR79029	Unavailable	INTRODUCTION TO THE LRAPP ENVIRONMENTAL-ACOUSTIC DATA BANK (U)	Naval Ocean R&D Activity	790601	ADB041066; NS	U
USRD NO. 4807	Unavailable	MEASUREMENTS ON AQUADYNE MODEL AQ-1 ELEMENTS FOR THE UPGRADED LAMBDA ARRAY	Naval Research Laboratory	790802	ND	U
Unavailable	Ellis, G. E.	SUMMARY OF ENVIRONMENTAL ACOUSTIC DATA ANALYSIS	University of Texas, Applied Research Laboratories	790814	ADA073876	U
BR U0048-9C2	Unavailable	TAP III FINAL REPORT (U)	Bunker-Ramo Corp. Electronic Systems Division	790901	ND	U
ORITR1245	Moses, E. J.	OPTIONS, REQUIREMENTS, AND RECOMMENDATIONS FOR AN LRAPP ACOUSTIC ARRAY PERFORMANCE MODEL (U)	ORI, Inc.	790917	NS; ND	U
Uavailable	Colborn, J. G., et al.	EVALUATION OF STANDARD OCEAN CANDIDATES	Pacific-Sierra Research Corp,	800301	ADA087304	U
Unavailable	Kirby, W. D.	ENVIRONMENTAL ACOUSTIC SUPPORT FOR FLEET OPERATIONS AND NATO	Science Applications, Inc.	801112	ADB052623	U
Unavailable	Unavailable	SUMMARY OF ENVIRONMENTAL ACOUSTIC MEASUREMENTS, MODELING AND ANALYSIS	University of Texas, Applied Research Laboratories	801215	ADB053770	U
Unavailable	Renner, W. W., et al.	SURFACE DUCT, ROUGH SURFACE SCATTERING, AND CUSPED CAUSTIC IMPROVEMENTS FOR FACT	Science Applications, Inc.	810301	ADA126250	U
Unavailable	Wilson, J. H.	WIND-GENERATED NOISE MODELING	Science Applications, Inc.	810401	ADA190143	U
Unavailable	Goit, E. H.	TOWED ARRAY PERFORMANCE PREDICTION SYSTEM - VERSION 1.2	Science Applications, Inc.	810701	ADB059397	U
3	Unavailable	FINAL REPORT	University of Texas, Applied Research Laboratories	810721	ND	U